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Treatment of Hormax Growth Regulating Substances on Early Germination and Growth of Sugarcane (*Saccharum Officinarum L.*)

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ABSTRACT

The average production of sugar is 2.26 million tons per year, while consumption is about 5.10 million tons per year. This is what causes the number of production and consumption of sugar shows a fairly high gap. Extensification approach in increasing sugar cane production to achieve sugar self sufficiency target is quite difficult to achieve, so intensification program is one of the efforts that can be done through evaluation and optimization phase of germination and plant growth with application of growth regulator (Fitohormon). If this is done then to obtain a sugar cane plant that has the productivity and optimal yield is likely to be achieved (Ahmad Khuluq and Ruly Hamida, 2014). The experiment was conducted at Experimental Garden of Agriculture Faculty, Merdeka University, April-June 2017. Using Randomized Block Design with 3 replications. and 8 doses of Hormax growing growth regulator, among others: 0 ml/l water (Control); 1 ml/l water; 2 ml/l water; 3 ml/l water; 4 ml/l water; 5 ml/l water; 6 ml/l water; 7 ml/l water. In conclusion, the use of Hormax significantly affected the germination rate, the number of leaves, the number of roots, the wet weight and the dry weight per cane plant. Increased dose of Hormax followed by an increase in all variables of sugar cane observation. The highest results were shown dose of Hormax 7 ml/l water), but statistically not significantly different from the treatment dose of Hormax 6 ml/l water) and dose of Hormax 5 ml/l water. It is recommended that to assist the germination and early growth of sugar cane using a dose of Hormax 5 ml/l water.

Keywords : Dose, Growth Hormax, Sugar cane

1. INTRODUCTION

Public demand for sugar continues to increase over time, this increase is due to the development of the population and the increasingly widespread industry that uses sugar raw materials. Average sugar production is 2.26 million tons per year, while consumption is around 5.10 million tons per year. This is what causes the sugar production and consumption figures to show a high gap.

In 2002-2007, the increase in sugarcane productivity was carried out through the national sugar productivity acceleration program and as a result Indonesia was able to self-sufficient sugar consumption directly in 2008. The success of the implementation of the acceleration program mentioned above, in 2010 the Government launched the National Sugar Self-Sufficiency Program until the year 2014 with a target of sugar production reaching 5.7 million tons, so that it can meet national sugar needs, both white crystalline and refined sugar. Strategies to achieve these targets

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include increasing the productivity of both sugar cane and sugar, expanding the area, revitalizing and developing sugar cane-based industries, strengthening institutions and financing as well as national policies. In order to achieve national sugar self-sufficiency in 2014 strategic steps were developed to support each other, namely the arrangement of varieties in order to optimize land and milled efficiency, so that sugar productivity increased (Anonymous, 2010).

The Indonesian Sugar Association (AGI) said that national sugar production in 2015 was recorded at only 2.49 tons. This achievement is lower than the national sugar production target set by the Ministry of Agriculture (Ministry of Agriculture) of 2.7 million tons. This sugar production is obtained from the concession area of 446,060 hectares (ha) which produces 30.1 million tons of harvested sugar cane, with crystal production reaching 5.60 tons per ha, sugar cane weight of 67.6 tons per ha and the yield rate of 8.28 percent . In the 2015 milling season, sugar production from all sugar companies in Java reached 1.5 million tons with an area of 276 thousand ha and produced milled sugarcane of 18.9 million tons, and crystal productivity of 5.55 tons per ha. Whereas outside Java, it was recorded to produce sugar production of 961 thousand tons with the support of 169 thousand tons of area which produced 11.2 million tons of milled sugar cane with 5.68 tons of hauled crystal production per ha. National sugar production in 2015 was lower than sugar production in 2014 which reached 2.57 million tons with crystal productivity of 5.41 tons per ha, sugarcane weight of 70.7 tons per ha and yield of 7.65 percent. The existence of el nino which was marked by extreme dry agriculture during the milling season caused the 2015 yield to be better than 2014, but the productivity of sugarcane decreased. As for the area, especially the people's sugar cane, it dropped significantly due to the low price of sugar throughout 2013 and 2014 (Septian Deny, 2016).

Extensification approach in increasing sugar cane production to achieve the sugar self-sufficiency target is quite difficult to achieve, so the possibility that can be done is through an intensification program for sugarcane plantations. One such effort is to carry out physiological engineering of sugarcane planting by evaluating and optimizing germination and plant growth phases with the application of growth regulating substances (Fitohormon). If this is done, then to get sugar cane plantations that have optimal productivity and yield are likely to be achieved. Growth hormone regulation is often used in initiating shoots on tissue culture multiplication techniques (Ahmad Khuluq and Ruly Hamida, 2014).

Germination is a critical phase for the life of sugar cane, and good germination is a good base capital for garden success (*safe crop*). Germination is a complex series of processes from the growth of morphology, biochemistry and physiology (Harjadi, 1991).

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Soil fertility that determines the success of sugarcane cultivation, involves aspects of soil physical and chemical limiting factors. The physical properties of the soil that stand out are drainage or permeability, texture and pore space. While the soil chemical properties are organic matter content, pH, essential nutrient availability and soil CEC. Suitable soil texture for sugarcane plants based on the nature of the soil is moderate to severe, namely the texture of clay, sandy loam, dusty clay, sandy clay, clay clay, dusty clay and clay or a slightly rough to smooth texture. The best soil acidity (PH) for sugarcane is in the range of 6.0 to 7.0 but love can grow at PH 4.5 to 7.5. Soil fertility (nutrient status), based on the results of P3G1 research to determine the suitability of materials for sugarcane plants with criteria for total N> 1.4, P_2O_5 available> 27 ppm, K_2O available> 150 ppm (Anonymous, 2008).

Increasing the speed of the growth process requires the availability of nutrients that are relatively fast, especially during critical periods in plants (Hariyadi, Ali, & Pratiwi, 2018). Hormax growth regulator with a composition that is very suitable for plants can meet the nutrient needs. The application of hormones in the process of fertilizer production is to create "nutrients" which have unique characteristics composed of very small particles, which are expected to be absorbed more quickly and digested by plants (Anonymous, 2012).

Further according to Simanungkalit et al. (2006), that the Hormax growth regulating agent is able to make plants healthier, thus reducing pests and diseases and not eliminating them altogether. Other advantages of these hormax growth regulating agents include: Natural, organic, non-toxic and environmentally friendly, passed quality testing and effectiveness testing, according to the provisions of the Indonesian Ministry of Agriculture Replication, its nutritional content is complete and balanced, contains natural growth stimulants, ionic form, so that it is easily and quickly absorbed by the mouth of the leaf (stomata), practical and economic in plants, suitable for all types of plants, also for livestock and fisheries, quality assurance and affordable prices. The presence of an organic growth stimulating hormone in hormax growth regulating substances has essentially a power function to build, encourage, stimulate, stimulate certain body parts. Growth regulators are complex organic compounds synthesized by high-level plants that affect plant growth and development.

In this study, the growth regulating agent used is the hormax growth regulating agent, where for the initial stage the dose limit is treated first, thus from this test the treatment expects to know the maximum and optimum dose treatment which is useful to increase the speed of germination and better growth of sugar cane, so that it can provide support for the achievement of sugarcane crops optimally.

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2. RESEARCH METHODS

place of research was at the Experimental Garden of the Faculty of Agriculture, Merdeka University, Surabaya, in Karah Village, Jambangan Subdistrict, Surabaya Municipality, the height of the place was 5 meters above sea level. Implementation time April-June 2017. Research materials include varieties of sugarcane cuttings of variety PS-881, soil and manure as planting media (2: 1), growth regulators of Hormax. Pest control is prioritized by mechanical means, whereas when explosive attacks are used Busudin 60 EC and Dithane M-45. Experiment tools include measuring cups, polybags (30 x 40 cm), buckets, rulers, stakes, exhouse scales, analytical scales, sprayers and electric ovens.

This study used a Randomized Block Design (RBD), with 8 levels of treatment dose of Hormax (H) growth regulator and 3 replications and 2 sample plants. As for the treatment, namely: H0 = 0 ml / l of water; H1 = 1 ml / l of water; H2 = 2 ml / l of water; H3 = 3 ml / l of water; H4 = 4 ml / l of water; H5 = 5 ml / l of water; H6 = 6 ml / l of water; H7 = 7 ml / l of water.

Analysis of the data used to determine the effect of treatment on this experiment is the Sidik Ragam Analysis (ASR) with F test, while to find out the difference in treatment used the Smallest Significant Difference Test (BNT) with a 5% confidence level (Yitnosumarto, 1991).

3. RESULTS AND DISCUSSION

3.1 Germination Speed

The results of variance analysis showed that the treatment dose of growth regulator Hormax significantly affected (F1%> F Calculate> F5%) on the observation of sugarcane germination rate (Appendix Table 1). This is in accordance with the statement of Agus Supriana (2012), that plant hormones are natural substances (formed by plants themselves) that act to regulate plant activity. While plant growth regulating substances include natural and synthetic plant hormones, but if applied to plants will affect the growth and development of these plants. Furthermore Lakitan Benjamin (2006) stated that the absorption of nutrients at the right time can cause nutrient concentration in cells to be more optimal, so as to be able to accelerate or accelerate germination and subsequent growth.

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Table 1. Average Sugarcane Plant Germination Speed Due to Treatment of Dosage of Hormax Growth Regulating SubstancesHormax Growth Regulating

Treatment of Substances	Average Sugarcane Plant Germination Speed (Days)
H0 (0 ml / l water)	6.77 d
H1 (1 ml / l water)	5.67 d
H2 (2 ml / l water)	5.50 d
H3 (3 ml / l water)	5.00 c
H4 (4 ml / l water)	4.67 c
H5 (5 ml / l water)	3.50 b
H6 (6 ml / l water)	3.17 ab
H7 (7 ml / l water)	3.00 a
BNT 5%	0.37

Description: Numbers accompanied by the same letter, in thecolumn sameshows not significantly different (BNT 5%).

In Table 1. it can be seen that the increasing application of treatment dose of growth regulators Hormax also accelerates the time needed for germination of sugarcane cuttings, where the speed of germination of cuttings of the best sugarcane cuttings is the fastest or the treatment of H7 (7 ml / l of water) is 3, 00 days, although statistically not significantly different from H6 treatment (6 ml / l water) of 3.17 days, while the results of late germination or take a long time, H0 treatment (0 ml / l water) was 6.77 days. .

The results of this study illustrate that the administration of Hormax growth regulating agent has an effect on increasing the physiological effects of plants during germination of sugarcane stem cuttings, then causing optimal germination acceleration at certain doses compared to the control treatment or without Hormax.

Gardner et al. (1991), suggested that the germination process would begin with the absorption of water from the soil which could then cause the embryo to produce a small amount of gibberellin then the hormone diffuses into the endosperm cells of the storage tissue, resulting in the formation of enzymes that lead endosperm cells to disintegrate and melt . In this process other hormones will be formed, namely Cytokinin and Auxin which will play a role in stimulating the growth of embryos through cell division and enlargement which can encourage the growth of shoots and roots, then once the shoots are exposed to sunlight, the plant begins to produce its own food through the process photosynthesis.

3.2 Number of Leaves

The results of variance analysis showed that the treatment dose of growth regulating agent Hormax significantly affected (F1%> F Count> F5%) on the parameters of the observation of the number of leaves of sugarcane plants at the age of observation 14 days, 28 days and 42 days after

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planting (Appendix Table 2). This is presumed, that the administration of growth regulating agents is more effective in the physiological processes of plants which ultimately can have a significant effect on the speed of germination. In general, to obtain optimal growth and development of sugar cane, it can be done by cultivating good growth or germination and germination. A good germination means a start of good growth and will be the base of a good harvest.

According to Rahardja and Wiryanta (2004), giving the concentration of auxin solution will have an optimal effect on the growth of the number of leaves produced. Auxin helps the cell division activity at the shoot, so that the process of cell extension in the young shoot tissue will occur and the shoot growth will be faster too.

Table 2. Average Number of Sugar Cane Leaves Observation Age 14, 28, 42 Days After Planting Due to Treatment of Substance Dose Hormax Growth Regulator

Treatment Dosage of Hormax Growth Regulator	Average Number of Leaves of Sugarcane Plant		
	14 Days	28 Days	42 Days
H0 (0 ml / l water)	3.33 a	10.33 a	18.00 a
H1 (1 ml / l water)	3.50 a	11.50 b	19.67 b
H2 (2 ml / l water)	3.67 a	11.83 b	19.83 bc
H3 (3 ml / l water)	4.33 b	12.50 c	20, 50 cd
H4 (4 ml / l water)	4.50 bc	12.67 c	20.67 d
H5 (5 ml / l water)	4.50 bc	13.33 d	21.50 e
H6 (6 ml / l water)	4.67 bc	13.50 d	21.67 e
H7 (7 ml / l water)	4.87 c	13.67 d	21.83 e
BNT 5%	0.43	0.52	0.71

Description: The numbers beside the same letter, the same column shows no significant difference (BNT 5%).

In Table 2. it can be seen that the increase in the application of the treatment dose of Hormax plant growth regulators will result in an increase in the initial growth of sugar cane, this is indicated by the increasing number of leaves. The highest number of leaves at the age of 42 days after planting resulted in a treatment dose of growth regulator Hormax H7 (7 ml / l water) of 21.83 leaves, although it was not statistically significantly different from the treatment dose of growth regulator Hormax H6 (6 ml / l water) 21.67 leaves as well as treatment dose of growth regulators Hormax H5 (5 ml / l water) as much as 21.50 leaves, while the results of the lowest leaf number at 42 days after planting resulted in the treatment dose of growth regulator Hormax H0 (0 ml / l of water) 18,00 leaves. This is presumed, that the administration of Hormax growth regulating agent is more effective in the physiological processes of plants which ultimately can give a significant influence on the process of leaf formation.

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According to Agustina (1989) *in* Heddy (1996), that after the seedlings grow with the root system and the size of the leaves that develop perfectly, the leaves will support the rapid rate of photosynthesis. The results of anabolism or preparation in that period allow an increase in the size of rapid growth, but the rate of total photosynthate increase does not always remain high. Gradually the plant will experience a decrease in the rate of photosynthate increase with increasing plant age, eventually stopping to grow and towards death.

Furthermore, according to Harjadi (1991), that leaf organ acts as the main photosynthetic producer during photosynthesis process, where the photosynthate results subsequently have an important effect on the growth and formation of plant biomass. Photosynthesis is the process by which carbon dioxide and water with the influence of sunlight and the presence of chloropil or green leaves are melted into an energy-rich organic compound.

3.3 Number of roots

The results of the analysis of variance showed that the treatment dose of growth regulators Hormax significantly (F1%> F Calculate> F5%) in observing the number of roots of sugarcane plants (Appendix Table 3).

Application of growth regulators Hormax, in the period of vegetative growth is intended to accelerate the growth and germination of roots, stems and leaves, so that plants are capable of optimal photosynthesis. The hormones contained are also very necessary in the growth of organogenesis including in root formation. The proper treatment of the solution can increase the initiation and induction of the roots in the cuttings seedlings (Anonymous, 2017).

Table 3. Average Number of Cane Plant Roots Due to Treatment of Dosage of Hormax Growth Regulating Substances

Treatment of Doses of Hormax Growing Regulators	Average Number of Cane (Strands) Plant Roots
H0 (0 ml / l water)	13.17 a
H1 (1 ml / l water)	15.83 b
H2 (2 ml / l water)	16.67 b
H3 (3 ml / l water)	19.50 c
H4 (4 ml / l water)	20.17 c
H5 (5 ml / l water)	23.00 d
H6 (6 ml / l of water)	23.50 d
H7 (7 ml / l of water)	24.83 d
BNT 5%	2,17

Remarks: the figures are accompanied by the same letter, in columnthe same shows not significantly different (BNT 5%).

In Table 3. it can be seen that the increase in the application of the treatment dose of Hormax growth regulating agent will result in an increase in the initial growth of sugar cane, this is

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indicated by the increasing number of leaves. The highest number of leaves at the age of 42 days after planting resulted in a treatment dose of growth regulator Hormax H7 (7 ml / l water) of 24.83 roots, although it was not statistically significantly different from the treatment dose of growth regulator Hormax H6 (6 ml / l water) 23.50 roots and treatment dose of growth regulators Hormax H5 (5 ml / l water) as much as 23.00 roots, while the results of the lowest leaf number at 42 days after planting resulted in a dose of Hormax H0 growth regulating agent (0 ml / l of water) 13.17 roots. This is presumed, that the administration of Hormax growth regulating agents is more effective in the physiological processes of plants which ultimately can have a significant influence on the process of root formation.

According to Agus Supriana (2012), that plant hormones are natural substances (formed by these plants themselves) which act to regulate plant activity. Harmon plants synthesized chemically can react to plants in the same way that people are caused by natural hormones. While plant growth regulating substances include natural and synthetic plant hormones but also others, chemicals not nutrients that are not found naturally in plants, but when applied to plants will affect the growth and development of these plants (Anonymous, 2012).

3.4 Wet Weight per Plant and Dry Weight per Plant

The results of variance analysis showed that the treatment dose of growth regulator Hormax significantly affected (F1%> Fcount> F5%) on the observation of wet weight and dry weight of sugarcane (Appendix Table 4). This is consistent with Harjadi's (1991) statement, that leaf organs act as the main photosynthetic producer during photosynthesis, wherein the photosynthate results further affect the growth and formation of plant biomass.

Table 4. Average Wet Weight and Dry Weight of Sugarcane Crops Due to Treatment of Dosage Substance Growth Regulator Hormax

Treatment Dosage Substance Growth Regulator Hormax	Wet Weight Per Plant (gram)	Dry Weight Per Plant (gram)
H0 (0 ml / l water)	115, 73 a	22.67 a
H1 (1 ml / l water)	124.03 b	27.83 b
H2 (2 ml / l water)	126.07 bc 29.30	b
H3 (3 ml / l water)	131.60 cd	33.87 c
H4 (4 ml / l water)	132.57 d	34.60 c
H5 (5 ml / l water)	139.73 e	38.93 d
H6 (6 ml / l water)	141.97 e	39, 30 d
H7 (7 ml / l water)	144.90 e	41.23 d
BNT 5%	6.27	3.43

Description: The numbers next to the same letter, in thecolumn sameshow not significantly different (BNT 5%)

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From table 4 it can be seen, that the increasing application of dose treatment of growth regulators Hormax further increases the wet weight per plant and dry weight per sugarcane, where the highest wet and dry weight per sugarcane plant was shown to be H7 (7 ml / l of water), namely 144.90 grams of wet weight and 41.23 grams of dry weight per plant, although it was not statistically significantly different from H6 treatment (6 ml / l water), as well as H5 treatment (5 ml / l water), which was 141.07 grams and 139.73 grams of wet weight and 39.30 grams and 38.93 grams of dry weight per sugarcane. The lowest yield of wet weight and dry weight per sugarcane plant was shown to be treatment of H0 (0 ml / l water), which was weighing 115.73 grams of wet weight and 22.67 grams of dry weight per plant.

The results of this study can provide an illustration that the administration of Hormax growth regulating agent has an effect on increasing the physiological effects of plants during germination of sugarcane stem cuttings and furthermore it will cause optimal germination acceleration up to a certain dose, when compared to the control treatment or without the use of growth regulators Hormax, so the speed of biomass formation to produce plant organs will be faster too.

The hormax growth regulating agent contains macro and micro elements needed by the plant, in addition to the hormonal content of IAA including auxin, zeasin, kinetin including cytokines, and GA3 including gibberellin, which can have an effect on plant growth and germination, effectively and efficient. Based on the results of the study, that the growth regulator Hormax is able to play a role in stimulating and increasing the growth of roots, stems, leaves and tillers quickly, also able to nourish plants that are sick or after harvesting the fruit. The growth regulating agent of Hormax can be used in plantation, horticulture, rice and secondary crops and vegetables, because it is non-toxic and does not cause pollution. The results of research on a number of plantation crops, such as rubber, tea, sugar cane, cocoa, tobacco, and rice and polowijo, are recommended, that the use of concentrations of Hormax growth regulators as much as 3-5 ml per liter of water will provide a better effect on growth parameters and yield the plant (Anonymous, 2012).

4. CONCLUSIONS

Based on the results of observations and statistical analysis, the conclusions are as follows: Application of growth regulators Hormax significantly affects the speed of germination, number of leaves, number of roots, wet weight and dry weight per sugarcane. The increasing application of treatment doses for growth regulators of Hormax was followed by an increase in the number of leaves, number of roots, wet and dry weight per plant and the speed of germination of sugarcane. The highest yield (yield and maximum dose) was shown by the treatment dose of growth regulator

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Hormax H7 (7 ml / l water), but not statistically significantly different from the treatment of growth regulator Hormax H6 (6 ml / l water) and H5 (5 ml / l water). Treatment without the use of growth regulator Hormax H0 (0 ml / l of water) showed the lowest results.

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